WHAT IS CLAIMED IS:

1. A photonic device comprising:

a medium of dielectric material with a substantially periodic one or two dimensionally periodic index contrast introduced into the dielectric material so that said medium has at least one resonant mode at a resonance frequency, so that the index of the medium varies periodically along at least one direction, and so that electromagnetic radiation incident upon the medium is substantially completely reflected over a range of frequencies, said range being greater than about 1% of the resonance frequency; and

a device directing electromagnetic radiation towards the medium along a path that is not along or parallel to said at least one direction.

2. The device of claim 1, wherein said medium has a periodic array of air holes having diameters of at least 0.2a, where a is the period of the array.

3. The device of claim 1, wherein said at least one direction is along a lattice translation vector of the medium of dielectric material.

4. The device of claim 1, wherein the index contrast of the medium varies periodically along two directions, and said path is not along or parallel to the two directions.

5. An apparatus comprising at least one photonic crystal and a reflector adjacent to one another, each of said crystals comprising a block of dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material.

6. The apparatus of claim 5, further comprising a device controlling a distance between the crystal and the reflector.

7. The apparatus of claim 6, wherein the device controls said distance to adjust the wavelength of radiation transmitted or reflected by the at least one crystal

8. The apparatus of claim 5, further comprising a detector detecting radiation transmitted or reflected by the at least one crystal to provide a signal indicative of said distance.

9. The apparatus of claim 5, further comprising a device controlling a lateral shift or relative rotation between the at least one crystal and the reflector.

10. The apparatus of claim 5, further comprising a detector detecting radiation transmitted or reflected by the at least one crystal to provide a signal indicative of said lateral shift or relative rotation.

11. The apparatus of claim 5, wherein said at least one crystal defines therein an array of air holes.

12. The apparatus of claim 11, wherein the array of holes in said at least one crystal has a periodicity a, said holes in such array having dimensions of at least about 0.2a.

13. The apparatus of claim 5, wherein said at least one crystal has a background reflectivity of at least about 0.5.

14. An optical apparatus comprising:

at least one photonic crystal and a reflective medium adjacent to one another, said at least one crystal comprising a block of dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material; and

a device controlling a distance between the at least one crystal and the reflective medium to adjust the wavelengths of radiation transmitted or reflected by the crystal.

15. The apparatus of claim 14, further comprising a detector detecting radiation transmitted or reflected by the at least one crystal to provide a signal indicative of said distance.

16. The apparatus of claim 14, wherein the at least one crystal defines therein an array of air holes.

17. The apparatus of claim 16, wherein the array of holes in at least said at least one crystal has a periodicity a, said holes in such array having dimensions of at least about 0.2a.

18. The apparatus of claim 14, wherein said at least one crystal has a background reflectivity of at least about 0.5.

19. A displacement sensing apparatus comprising:

at least one photonic crystal and a reflective medium adjacent to one another, said at least one crystal comprising a block of dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material; and

a detector detecting radiation transmitted or reflected by the at least one crystal to provide a signal indicative of a distance, or of a lateral shift or relative rotation, between the crystal and the reflective medium.

20. The apparatus of claim 19, wherein the at least one crystal defines therein an array of air holes.

21. The apparatus of claim 20, wherein the array of holes in said at least one crystal has a periodicity a, said holes in such array having dimensions of at least about 0.2a.

22. The apparatus of claim 19, wherein said at least one crystal has a background reflectivity of at least about 0.5.

23. A method for designing a photonic reflector or filter comprising:

providing a dielectric material; and

causing a substantially periodic one or two dimensionally periodic index contrast to be introduced into the material by introducing into the material a periodic array of air holes, said holes having diameters of at least 0.2a, where a is the period of the array so that the material has a scattering strength thereby causing it to be substantially completely reflective over a range of frequencies;

selecting a dimension related to said index contrast that is introduced so that the material has a scattering strength thereby causing it to be substantially completely reflective over a range of frequencies, said range being greater than about 1% of the resonance frequency.

24. A method controlling optical characteristics of an optical device, comprising:

placing at least one photonic crystal and a reflective medium adjacent to one another, said at least one crystal comprising a block of dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material, said

controlling a distance between, or a lateral shift or relative rotation between, the crystal and the reflective medium to adjust the wavelengths of radiation transmitted or reflected by the at least one crystal.

25. The method of claim 24, further comprising detecting radiation transmitted or reflected by the at least one crystal to provide a signal indicative of said distance or lateral shift.

26. A method for sensing displacement comprising:

placing at least one photonic crystal adjacent to a reflective medium, said at least one crystal comprising a block of dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material; and

detecting radiation transmitted or reflected by the at least one crystal to provide a signal indicative of a distance, or of a lateral shift or relative rotation, between the at least one crystal and the reflective medium.

27. An optical apparatus comprising:

two structures adjacent to one another, at least one of said structures comprising a dielectric material with one or two dimensional index contrast introduced into the dielectric material; and

a device controlling a distance between the structures to adjust the wavelength of radiation transmitted or reflected by the structures.

28. A displacement sensing apparatus comprising:

two structures adjacent to one another, at least one of said structures comprising a dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material; and

a detector detecting radiation transmitted or reflected by the structures to provide a signal indicative of a distance, or of a lateral shift or relative rotation, between the structures.

29. An optical apparatus comprising:

two photonic crystals adjacent to one another, each of said crystals comprising a block of dielectric material with one or two dimensionally periodic index contrast introduced into the dielectric material; and

a device controlling a distance between the crystals to adjust the wavelengths of radiation transmitted or reflected by the crystals

30. The apparatus of claim 29, further comprising a detector detecting radiation transmitted or reflected by the crystals to provide a signal indicative of said distance.

31. The apparatus of claim 29, wherein the at least one of the crystals defines therein an array of air holes.

32. The apparatus of claim 31, wherein the array of holes in at least one of said crystals has a periodicity a, said holes in such array having dimensions of at least about 0.2a.

33. The apparatus of claim 29, wherein at least one of said crystals has a background reflectivity of at least about 0.5.

34. A photonic device comprising:

a medium of dielectric material with a substantially periodic one or two dimensionally periodic index contrast introduced into the dielectric material so that said medium has at least one resonant mode at a resonance frequency, said medium having a boundary between the medium and an ambient environment, so that electromagnetic radiation incident upon the medium is substantially completely reflected over a range of frequencies, said range being greater than about 1% of the resonance frequency; and

a device directing electromagnetic radiation towards the boundary of the medium from the ambient environment.